(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: METHOD AND APPARATUS FOR GENERATING A ROBUST REFERENCE IMAGE OF A CONTAINER AND FOR SELECTING OF A CONTAINER
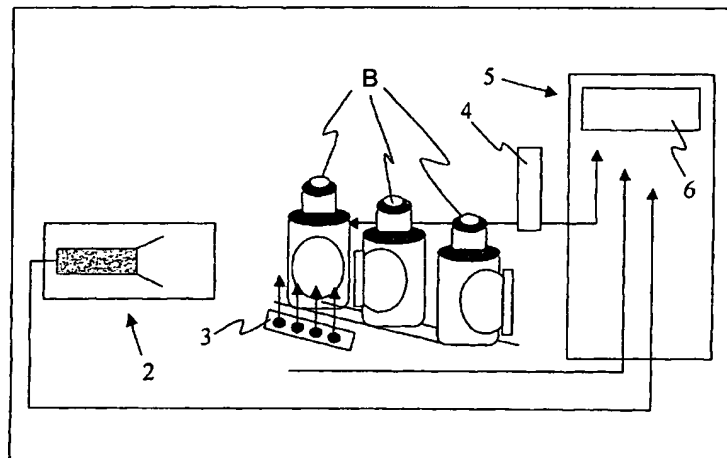
(57) Abstract: The present invention provides a method for composing a robust reference image or reference image with permissible deviation values of the exterior of a series of practically identical containers, such as bottles, crates and the like, comprising steps for: a) making an image recording of a part of the exterior of a plurality of containers from the series; b) processing the recorded image in order to obtain a first representation; c) composing a complete peripheral view of the exterior of the container on the basis of the first representations; d) determining, on the basis of all recorded images and parameters to be preset, the robust reference image of the container on the basis of which acceptable differences can be taken into account during selection of containers.

WO 03/042673 A1

European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:
— *with international search report*

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METHOD AND APPARATUS FOR INTER ALIA SELECTING OF A CONTAINER

The present invention relates to systems for selecting
containers, comprising steps for detecting aberrations in the
5   exterior of the container. Such systems are important since,
in the market for containers such as for instance bottles or
crates, such containers with a modern appearance impart a
commercial added value to the products supplied therein.
Damage or imperfections on such containers will however
10   detract greatly from the high perceived value of the
products.

Containers with a damaged exterior greatly impair the
image of the product for the modern consumer. In order to
prevent such impairment, it is important that the containers
15   are properly inspected.

In order to enable such an inspection, the present
invention provides a method for composing a robust reference
image, or a reference image with permissible deviation values
of the exterior of a series of practically identical
20   containers, such as bottles, crates and the like, comprising
steps for:

-making an image recording of a part of the exterior of a
plurality of containers from the series,

-processing the recorded image in order to obtain a first
25   representation,

-composing a complete peripheral view of the exterior of
the container on the basis of the first representations,

-determining, on the basis of all recorded images and
parameters to be preset, the robust reference image or
30   reference image on the basis of which acceptable differences
can be taken into account during selection of containers.

Such a robust reference image is preferably obtained by
determining, preferably per pixel, a mean value of the image

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and a mean deviation (standard deviation) thereof; the robust
reference image then consists of two parts. It is preferably
built up by starting with an image, whereafter subsequent
images are automatically added thereto until, for instance

5   after 1000 bottles, the robust reference image is complete.
This can hereby take place during normal use of the
installation, while the images of bottles in different
positions show coherence.

Such a robust reference image, or a reference image with

10   permissible deviation values, is important since printed
bottles for instance differ slightly from each other due to
for instance the production method. Printed or adhered labels
can for instance be shifted somewhat in height or be printed
in slightly deformed manner. Such deviations are however no

15   reason for rejection. An apparatus which would not take into
account such deviations would however select bottles for
rejection if such deviations are observed. According to the
present invention a robust reference image, or a reference
image with permissible deviation values, is therefore

20   composed in which acceptable deviations are taken into
account. Such deviations may comprise damage, size, features
or colour differences.

An example of such a method is that a reference image can
be formed on the basis of data obtained on the basis of the

25   containers used in practice. In order to manufacture the
robust reference image, image recordings are made of for
instance at least a thousand containers. Such a quantity
gives sufficient deviation information for approving the
normally occurring, acceptable deviations during a selection

30   process of containers.

The above described method for composing a robust
reference image or reference image with permissible deviation
values for the exterior of a series of practically identical

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containers preferably comprises steps for applying
statistical analysis methods in determining the robust
reference image. Using such steps it is possible to use
standard deviations, or for instance to apply factors to such

5   standard deviations in order to obtain an optimal ratio
between acceptance and rejection of containers in a selection
process. Such an optimal ratio can for instance be determined.
on the basis of the cost of the containers in relation to a
market value assessment based on the value of high-quality

10   containers as perceived by consumers.

        A further aspect of the present invention relates to a
method for selecting a container, such as a crate or bottle
and the like, comprising steps for detecting deviations on
the exterior of the container, comprising steps for:

15   -making an image recording of a part of the exterior,
        -processing the recorded image in order to obtain a
second representation,
        -comparing the second representation to a robust
reference image.

20   Processing of the recorded image preferably comprises
steps for transforming an aspect view of a curved surface to
a faithful flat rendition. Using a method according to such a
preferred embodiment, the exterior of a container, such as
for instance a label arranged thereon or a printing applied

25   thereto, can be compared to the robust reference image or the
reference image with the permissible deviation values of the
exterior of a series of practically identical containers.

        Image recordings are herein made of a part of the side
wall of for instance round containers. In practice a readily

30   processable recording is made of for instance 60˚ of the
periphery. A wider recording of for instance 120˚ is also
possible. The theoretically feasible recording of 180˚
however produces in practice less useful results close to the

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edges. In the case of a container with straight walls such as a square or rectangular container, recordings are made of a whole side wall.

In the case of a round container such as a bottle, the
5 robust reference image comprises a faithful flat rendition of the whole side wall over 360˙. The recording of for instance 60˙ which is made in the present embodiment, is fitted onto the corresponding part of the robust reference image after being processed to a faithful flat rendition. A comparison is
10 then made as to whether the similarities fall within the set limit values of the robust reference image, which results in approval of this part-image and thereby the bottle, or that the present image falls outside the tolerances of the robust reference image, which results in rejection of the present
15 bottle.

In a further embodiment use is made of the second representation to compose the robust reference image. This embodiment has the advantage that in the reference image, or in the deviation values included therein, account is taken of
20 data of containers of which recordings are made during the method for selection. During the selection process, the robust reference image is hereby more and more adapted to a series of deviation values to be detected. In statistical terms this means that the sample size on the basis of which
25 deviation values are determined becomes increasingly larger.

In order to obtain a sufficiently high speed (for instance 16 bottles/sec), use is preferably made of a coarse and a fine fitting.

Approval or rejection preferably takes place using
30 distinguishable, parameterized differential measurements, such as colour difference, shape difference (non-roundness and the like) and so on.

5

    The parameters preferably comprise data relating to the
container, threshold values relating to colour differences or
formats of printing and the like. It is important for the
appearance of the container that for instance a printing is
5   placed somewhat at the correct height; variations in the
height of the printing will however, within limits, detract
little from the appreciation of a container by an end user.
Variations therein are therefore allowed. Too rigid an
assessment of the height of the printing would therefore
10 result in undesirable rejection. Such undesirable rejection
is prevented by taking this into account using this method.
The same sort of reasoning applies in relation to for
instance colour differences or differences in printing
format. Small aberrations herein can occur in large series of
15 containers. By taking account of data relating to large
quantities of containers of a series, undesirable rejection,
which involves high costs, is prevented.

    In order to be able to work in simple manner with
containers from different series, a preferred embodiment of
20 the method comprises the possibility of composing profiles
comprising the above described data for the purpose of
carrying out selections on mutually alternating series of
containers matching respective profiles. If such a method is
performed using an apparatus for selecting the containers, it
25 is recommended to process different series of containers in
efficient manner using one apparatus. These profiles enable
simple switching of series, wherein the correct selections
are made by applying the profile matching the series.

    In a further preferred embodiment the container is
30 illuminated while the recording is made. This has the
advantage for instance that a usable recording can be made by
applying sufficient light. By applying light of the same
intensity and colour in different recordings, it is further

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possible to make recordings wherein data relating to the
colour of the exterior of the container, such as a printing,
is kept constant, whereby the forming of a robust reference
image or the assessment on the basis of colour aspects of the
5 exterior of the container can be performed with constant
quality.

The container is preferably a bottle or a crate. Such
containers as bottles or crates are very important in a
distribution channel for the value perceived by consumers.

10   In the preferred embodiment the processing speed of the
containers is higher than ten containers per second,
preferably higher than sixteen containers per second. A high
processing speed is important for the manufacturers of
products sold in the containers. In practice it is very
15 practical to carry out the method subsequent to filling of
containers. Such containers, such as bottles, are filled in a
filling line. The method for selecting and building up the
robust reference image must then be performed at the same
speed as the filling of the bottles. In practice, this speed
20 is becoming increasingly higher.

Particularly in the case of bottles, use is preferably
made of skimming light on the top and bottom, wherein the
background remains as dark as possible.

A further aspect of the present invention relates to an
25 apparatus for selecting containers, comprising:
        -recording means for making at least one recording of
part of a side of the container directed toward the recording
means,
        -processing means for processing a recorded image in
30 order to obtain a first or second representation,
        -transmitting means for transmitting recording data to
the processing means,

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-comparing means for comparing the second representation
to a robust reference image obtained on the basis of
parameters to be preset and data from first or second
representations.

5   Such an apparatus preferably further comprises composing
means for composing, on the basis of first and second
representations and/or predetermined parameters, a robust
reference image or a reference image with permissible
deviation values, on the basis of which image acceptable

10   and/or natural differences between individual containers
within a series of containers can be taken into account
during selection of containers. Such apparatus embodiments
are able to perform an above described method and have at
least the above described advantages.

15   Such an apparatus preferably further comprises ejecting
means for ejecting selected containers. Selected containers
are in this respect containers which do not conform to the
robust reference image, or the reference image with
permissible deviation values.

20   The use of illuminating means and screening means while
making the recording increases the quality of the recording.

        In the further preferred embodiment the apparatus
comprises actuating means for actuating making of a recording
when a container is correctly positioned relative to the

25   recording means. An advantage hereof is that a recording is
made which is centred as accurately as possible relative to
the container. A further advantage is that it is possible to
keep track of which container is being assessed.

        The apparatus preferably comprises rotating means for

30   rotating the container between the making of two successive
recordings. Such an embodiment enables making of a plurality
of recordings of one container, whereby on the basis of
complete information relating to the exterior of the

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container it is possible to assess whether it falls within
the correct tolerances.

A significant advantage of the present invention relates
to the possibility, using differential images, of detecting
5   contaminants such as cigarette ends and the like in bottles
with printed, i.e. partly transparent, labels, since the
image information of the labels can be filtered out.

Further advantages, features and details of the present
invention will be elucidated on the basis of the following
10 description of preferred embodiments thereof with reference
to the annexed figures, in which:

- fig. 1 is a schematic side view of an apparatus for
selecting a container;

- fig. 2 is a top view of an apparatus as shown in fig.
15 1;

- fig. 3 is a top view of a further embodiment;

- fig. 4 is a top view of a further embodiment;

- fig. 5 is a schematic view of a representation of a
computer screen;

20   - fig. 6 is a top view of a further embodiment;

- fig. 7 is a schematic view of a computer screen;

- fig. 8-10 show flow diagrams of further embodiments
according to the present invention.

A first embodiment (fig. 1) comprises a camera 2,
25 illuminating means 3, actuator means 4 and a processing
computer 6 which is placed in a protective housing 5.
Actuator means 4 serve for making an image recording at the
correct moment by means of camera 2. The illuminating means
provide illumination of the bottle from the top and/or
30 bottom. In this embodiment the illuminating means are
embodied as light-emitting means in the form of for instance
a prism or a semicircular cylindrical lens which is connected
to a number of light-supplying glass fibre bundles. This

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embodiment makes it possible to provide a number of adjacent
light sources with light by means of one centrally placed
light source. The maintenance of such lighting is hereby
simple.

5   The bottles are transported past the lighting and the
camera by means of a conveyor 7 (shown schematically).
Bottles B are situated in a random orientation relative to
the camera. In this embodiment a recording is made by the
camera which covers 1/6 of the periphery of the bottle.

10   In the image processing computer 6 this recording is
processed such that an image is obtained as if the periphery
of the bottle had been rolled out. For this purpose the image
information is stretched to some extent towards both sides of
the image recording relative to the image information in the

15 centre of the recording. The thus obtained flat
representation is compared to a stored reference image or
robust reference image. The method for obtaining this robust
reference image is discussed in greater detail hereinbelow. A
robust reference image comprises data relating to a plurality

20 of images of bottles. Another manner of describing the robust
reference image is that it comprises data relating to one
graphic representation of a periphery of a bottle, together
with data concerning maximum desired deviations from this
ideal reference image. These permitted deviations are related

25 to the desired degree of rejection and the desired quality of
the images on the periphery of the container.

    In this embodiment the comparing takes place on the basis
of creating a differential image, by subtracting the
reference image from the flat representation of the recorded

30 image of the bottle for testing. The result of this
subtraction is a so-called first differential image D. Using
data relating to the mean differential image correction E, a
second differential image F is then calculated on the basis

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of the first differential image D minus the mean differential image correction E.

A top view of the embodiment of figure 1 is shown schematically in figure 2. Bottles B on conveyor belt 7 have
5 a pitch distance of the diameter of one bottle. This is important for determining the position of assessed bottles. After the recording of the side walls of the bottles has been made, the rejected bottles are ejected from the conveyor belt. A practical method of ejecting the correct bottle is by
10 knowing the number of transport positions of the bottles between recording of the image and the ejection, and by ejecting the correct bottle on the basis thereof.

Figure 2 further shows schematically a protective cover 9 which screens the bottle at the position of the camera from
15 unpredictable ambient light influences. It is possible here to envisage shadows of passing staff or variations in daylight or other light effects.

A further embodiment according to the present invention is shown in figure 3. Two cameras 2 are herein situated on
20 either side of conveyor belt 7. In this embodiment illuminating means 3 are also situated at the position of the cameras. Since it is possible in this embodiment to make two recordings along two sides of a bottle, the selection of the bottle can be carried out on the basis of twice the amount of
25 data. Where in the first embodiment the selection is carried out on the basis of one image of 60° of the periphery, it is possible in this embodiment to carry out the selection on the basis of 120° of the periphery of the bottle. The chance of bottles being approved erroneously is hereby halved relative
30 to the preceding embodiment.

In a further embodiment (fig. 4) a maximum of seven recordings are made of a bottle, and the bottle is rotated about its central axis during this period. The bottles are

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fed in the direction of arrow A over a conveyor belt 9. At
the position of the cameras, the bottles are urged toward a
second conveyor belt by means of guide belt 8. The bottles
are then discharged on the right-hand side in the direction

5 of arrow A. During this process the bottles are illuminated
from the underside by illuminating elements 3, which are
similar to the illuminating elements 3 of the embodiments of
figures 1-3. Cameras 2 make recordings of the passing
bottles. Guide means 8 are arranged at an angle   to conveyor

10 belt 9. A bottle is hereby pressed against guide means 8
during the whole of the transport from left to right. The
friction between the bottle and guide means 8 brings about
rotation of the bottle. The rotation can be influenced by
adjusting the relative speed of guide means 8 and the bottle.

15 For this purpose the guide means 8 are embodied as a conveyor
which moves in the direction of arrow F.

In this embodiment the resolution of the camera is 640 by
480 pixels. Depending on the desired selection quality, the
image quality can be increased to for instance 600 by 800,

20 1024 by 768 or for instance 1280 by 960 pixels. The
resolution of 640 by 480 pixels enables rejection of the
bottle on the basis of defects of 2 by 2mm in the exterior of
the bottle. If higher camera resolutions are used, it becomes
possible to reject smaller deviations. The desirability

25 hereof depends for instance on the cost of rejecting bottles.
Making a recording of the bottle is preferably further
actuated by means of a sensor which measures the arrival of
the bottle at the position of the neck. The embodiment is
further at least suitable for the so-called longneck (XLN)

30 bottle. However, through the above stated use of profiles, an
unlimited number of different bottles can be detected using
this embodiment.

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For operation by means of a computer of the above
described system, a screen display (fig. 5) of a computer
program is shown. At the top are situated several control
buttons 27 and on the right-hand side several input fields
5   28. The large image display area at bottom left provides a
rolled-out, complete peripheral view of a bottle 22, several
60˙ recordings 24, 25, 26 and an image recording 23.

In a further embodiment (fig. 6) crates C are assessed as
to their exterior. For this purpose recordings are made
10   beneath screening covers 37 of the side walls of the crate.
Recordings are made of both the long sides and the short
sides of the crate. The image data of the crate is
transmitted from the camera to a processing computer 36 which
is placed adjacently of the wall in a robust housing 35.

15   An embodiment of the inspection method is further
described hereinbelow on the basis of the inspection of a
crate. In step 51 (fig. 7) an image recording is made of a
side wall of a crate. The recorded image 52 is used to
determine the type of crate in step 53. Data relating to the
20   crate type 54 is used in step 55 to select the settings of
the assessment program. This data, the so-called crate
profile, or crate role 57, is used in step 56 together with
the recorded image to determine the correct part of the crate
periphery for the comparison between the recorded image and a
25   reference image. In step 63 the data relating to the image of
the crate is compared to the mean reference image 62. Data 64
relating to shift, rotation, shrinkage and/or other geometric
deformation of the image are inserted in a transformation
vector 66. In step 67 the image is deformed into a reference
30   image. The result is aligned image 79. In step 81 the
difference is measured between this aligned image and a
cut-out image 93 to be further described. The resulting
current differential image 82 is compensated in step 83 on

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the basis of the mean differential image 87. The result
hereof is the compensated differential image 84 which is
exported in step 88.

In step 60 an image mask 61 is further produced. In step
5   68 the shrinkage is extracted from transformation vector 66,
which results in shrinkage data 80. This shrinkage data is
exported in 85 and 86. On the basis of the shrinkage data and
image mask 61, the image mask is compensated for shrinkage 80
in step 69, which results in a compensated label mask 72.

10   Image data 59 of crate and handgrip further resulting
from step 56 are subjected to a positioning measurement in
step 65, which results in data relating to a horizontal
and/or vertical shift and/or rotation relative to camera 70.
This data 70 is exported in 71. This data 70 is further used
15 in the compensating in 69. The compensated image mask 72 is
compared to a blanking mask 76. This blanking mask 76 is the
reference mask of the label. The resulting arrangement
position data of a label on a crate 74 is used in 75 together
with transformation vector 66 and the horizontal shift
20 relative to camera 70 to calculate the blanking position 92.
This data 92 is exported in 93. In step 89 a reference label
is cut out on the basis of the mean reference image 62 and
blanking mask (is reference mask) 76, in order to produce
reference cut-out label 93.

25   The operation of the inspection of the crate colour and
crate handgrip is explained with reference to the method of
figure 8. Data 91 and data 71 are added to step 100 together
with data 86.

In step 100 image data is compensated for shrinkage and
30 horizontal shifting, which results in a stretched crate and
handgrip image 101. In step 102 profile data is selected for
the crate and handgrip. In step 105 profile data 104 is used
together with data relating to the reference profile of crate

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108 in order to measure a colour difference. Colour
difference data 106 is exported in 107. Profile data relating
to the handgrip resulting from step 102 is segmented to the
handgrip in step 109. Handgrip image data 110 resulting from
5   step 109 is processed in step 111 by means of a differential
measurement on the basis of reference data 112 of the
handgrip. Differential image data 113 relating to the
handgrip is exported in 114.

The validation of crate and label is described with
10   reference to figure 9. Data 88, 85, 86, 93, 107 and 114 are
inspected in step 127. In step 128 is determined whether the
crate is approved. In the case that the crate is not
approved, this is shown in step 129. If the crate is approved
in step 128, it is determined in step 130 whether the
15   reference data must be updated. A reason herefor is that a
deviation relative to the mean reference images is for
instance found which does not justify rejection. Such data is
then included in the reference images, or reference data in
steps 131-134. In step 131 the mean differential image is
20   modified. In step 132 the reference image is modified. In
step 133 the crate profile is modified and in step 134 the
handgrip profile is modified.

The present invention is not limited to the above
described preferred embodiment thereof, the rights sought
25   being rather defined by the following claims, within the
scope of which many modifications can be envisaged.

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CLAIMS

1. Method for composing a robust reference image or
reference image with permissible deviation values of the
exterior of a series of practically identical containers,
such as bottles, crates and the like, comprising steps for:
　　　-making an image recording of a part of the exterior of a
plurality of containers from the series,
　　　-processing the recorded image in order to obtain a first
representation,
　　　-composing a complete peripheral view of the exterior of
the container on the basis of the first representations,
　　　-determining, on the basis of all recorded images and
parameters to be preset, the robust reference image of the
container on the basis of which acceptable differences can be
taken into account during selection of containers.

2. Method as claimed in claim 1, further comprising steps
for applying statistical analysis methods in determining the
robust reference image.

3. Method for selecting a container, such as a crate or
bottle and the like, comprising steps for detecting
deviations on the exterior of the container, comprising steps
for:
　　　-making an image recording of a part of the exterior,
　　　-processing the recorded image in order to obtain a
second representation,
　　　-comparing the second representation to a robust
reference image.

4. Method as claimed in claim 1, 2 or 3, wherein
processing of the recorded image comprises steps for
transforming an aspect view of a curved surface into a
faithful flat rendition.

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5. Method as claimed in claim 1 or 2, wherein use is made of the second representation according to claim 3 to compose the robust reference image.

6. Method as claimed in one or more of the foregoing
5   claims, wherein the parameters comprise data relating to the container, threshold values relating to colour differences or formats of printing and the like.

7. Method for composing profiles comprising data from one or more of the foregoing claims for the purpose of carrying
10   out selections on mutually alternating series of containers matching respective profiles.

8. Method as claimed in one or more of the foregoing claims, further comprising steps for illuminating the container while making the recording.

15   9. Method as claimed in one or more of the foregoing claims, wherein the container is a bottle.

10. Method as claimed in claim 9, wherein the bottle is a glass bottle.

11. Method as claimed in claim 9 or 10, wherein the
20   bottle is a beer bottle.

12. Method as claimed in claim 11, wherein the beer bottle has a long neck.

13. Method as claimed in one or more of the claims 1-8, wherein the container is a crate.

25   14. Method as claimed in claim 13, wherein the crate is a crate for bottles containing a drink.

15. Method as claimed in one or more of the foregoing claims, wherein the processing speed is higher than ten containers per second, preferably higher than sixteen
30   containers per second.

16. Apparatus for selecting containers, comprising:

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-recording means for making at least one recording of part of a side of the container directed toward the recording means,

-processing means for processing a recorded image in
5 order to obtain a first or second representation,

-transmitting means for transmitting recording data to the processing means,

-comparing means for comparing the second representation to a robust reference image obtained on the basis of
10 parameters to be preset and data from first or second representations.

17. Apparatus as claimed in claim 16, further comprising composing means for composing, on the basis of first and second representations and/or predetermined parameters, a
15 robust reference image or the reference image with permissible deviation values, on the basis of which image acceptable and/or natural differences between individual containers within a series of containers can be taken into account during selection of containers.

20   18. Apparatus as claimed in one or more of the claims 16-17, further comprising ejecting means for ejecting selected containers.

19. Apparatus as claimed in one or more of the claims 16-18, further comprising illuminating means for illuminating
25 the container while making the recording.

20. Apparatus as claimed in one or more of the claims 16-19, further comprising screening means for screening the containers from ambient light influences while the recording is being made.

30   21. Apparatus as claimed in one or more of the claims 16-20, further comprising actuating means for actuating making of a recording when a container is correctly positioned relative to the recording means.

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22. Apparatus as claimed in one or more of the claims 16-21, wherein the recording means comprise at least one camera.

23. Apparatus as claimed in one or more of the claims
5   16-22, wherein a camera is disposed on at least two sides of the container.

24. Apparatus as claimed in one or more of the claims 16-23, further comprising rotating means for rotating the container between the making of two successive recordings.

10   25. Apparatus as claimed in claim 24, wherein the rotating means comprise displacing means for lateral displacement, and friction means for causing rotation in that the container is pressed against the friction means by means of the lateral displacement.

15   26. Apparatus as claimed in claim 25, wherein the friction means comprise a conveyor belt.

27. Apparatus as claimed in any of the claims 16-25, wherein the containers are transported on a carrousel.

28. Apparatus as claimed in any of the claims 16-27,
20 wherein one or more cameras are disposed in stationary manner relative to transport means for the containers.
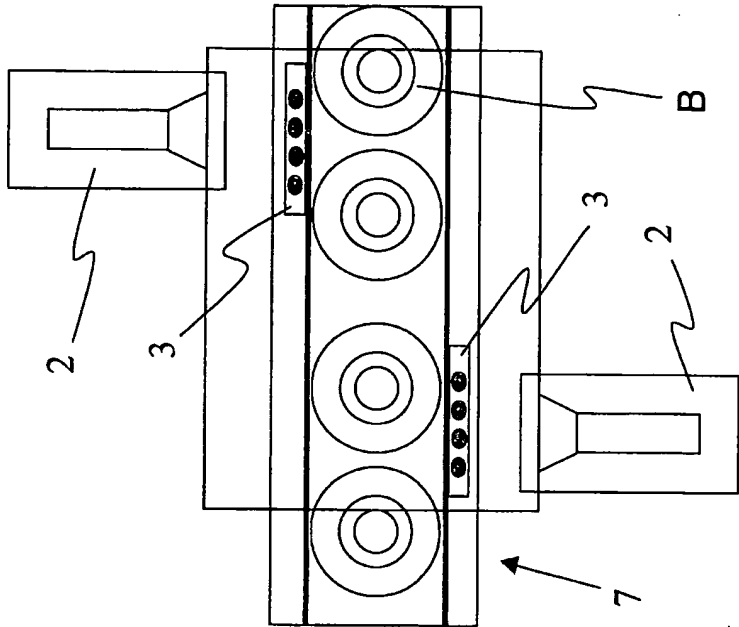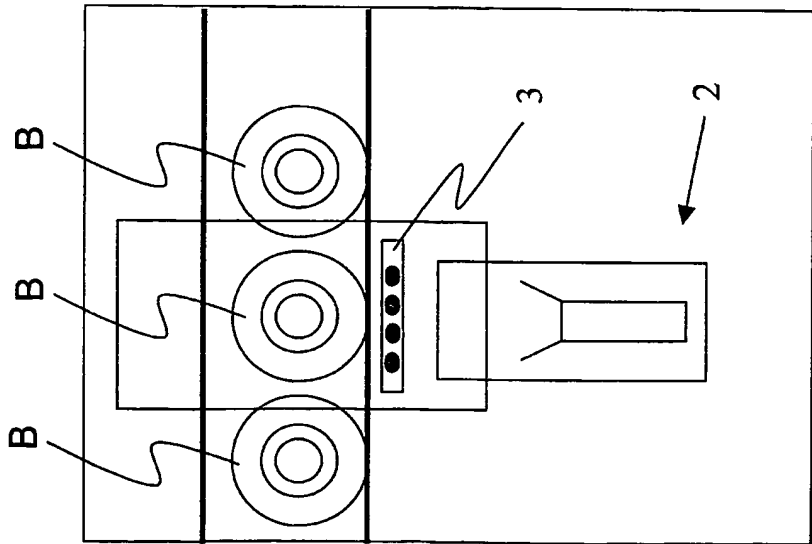
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FIG. 1

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FIG. 3
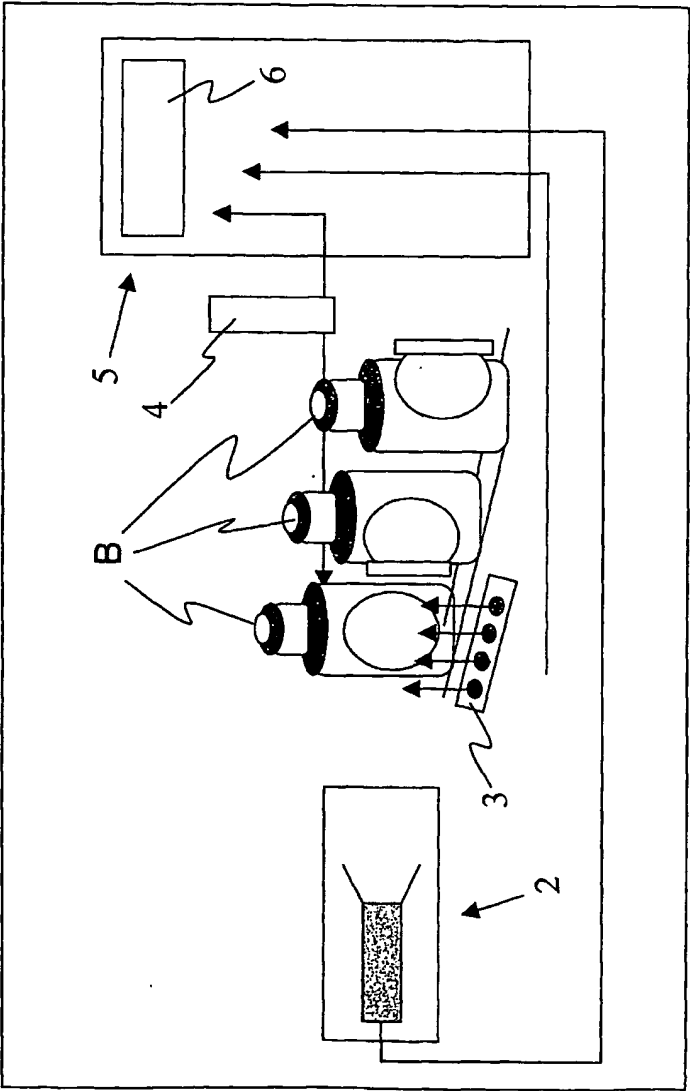
FIG. 2

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FIG. 4

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FIG. 5

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FIG. 6

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FIG. 7

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FIG. 8

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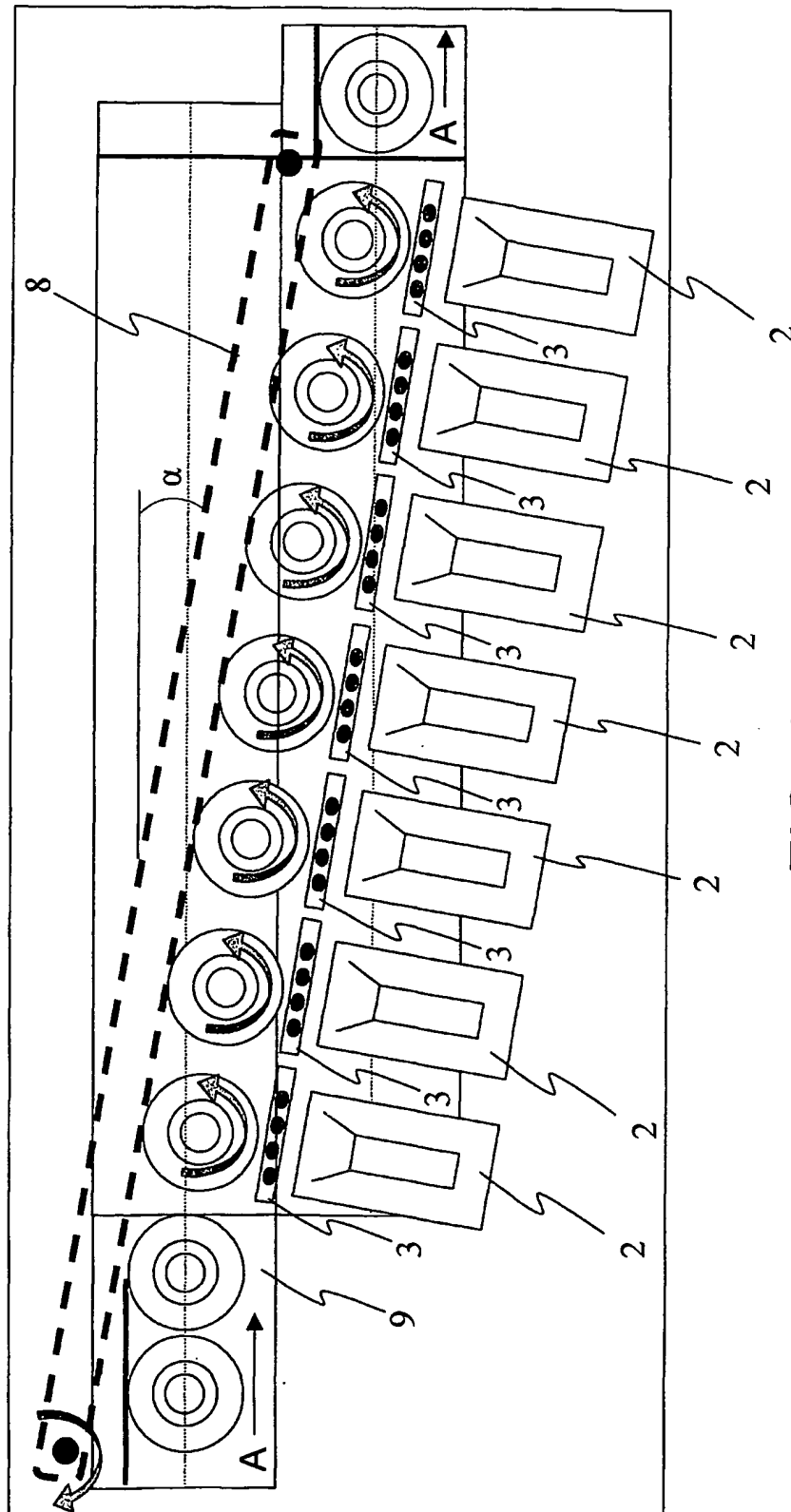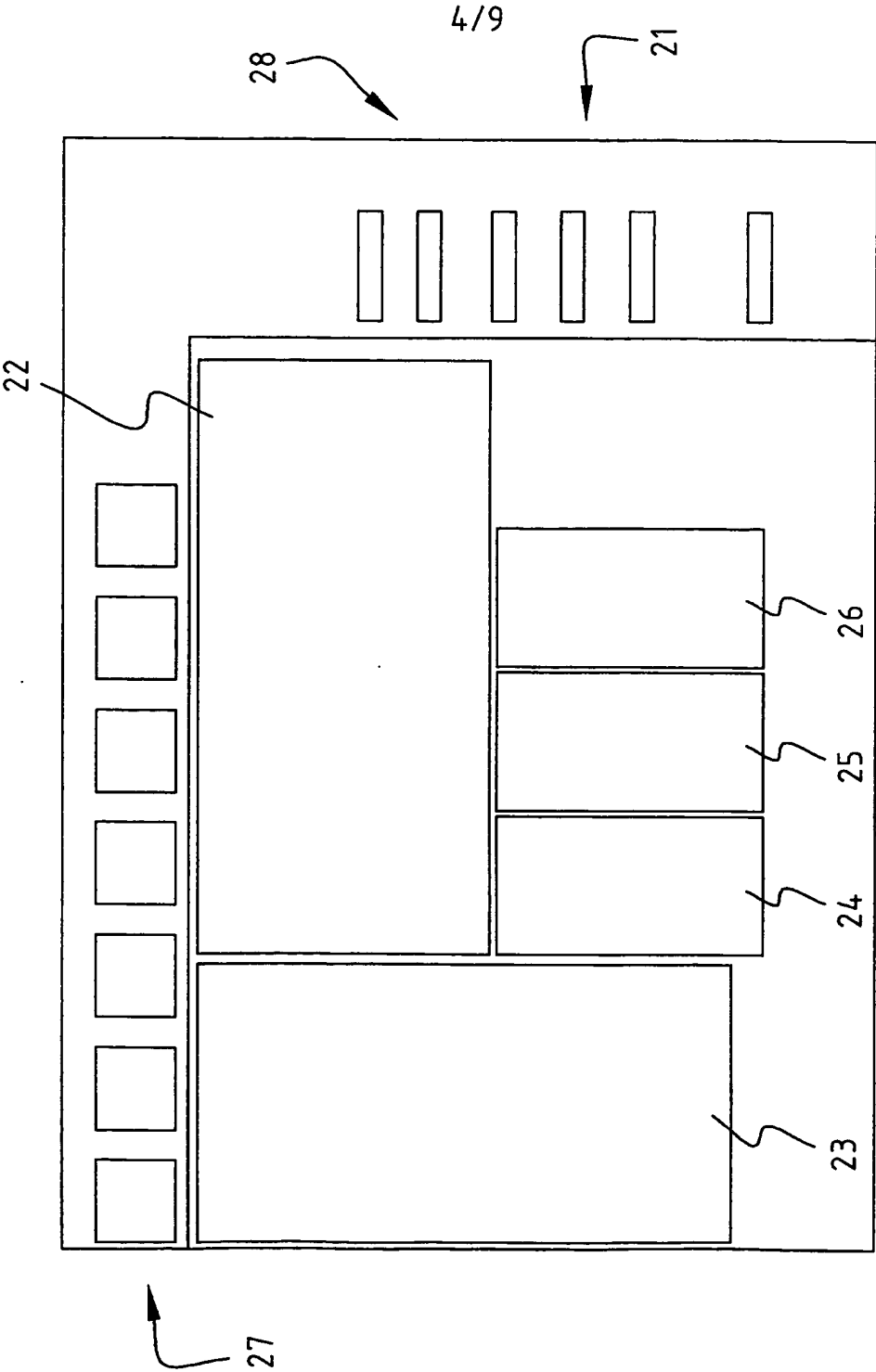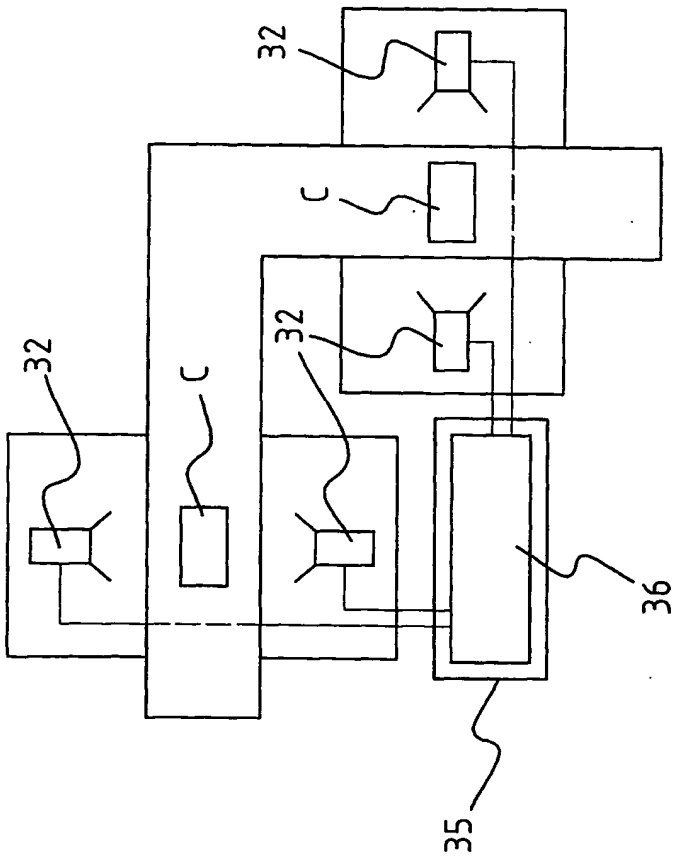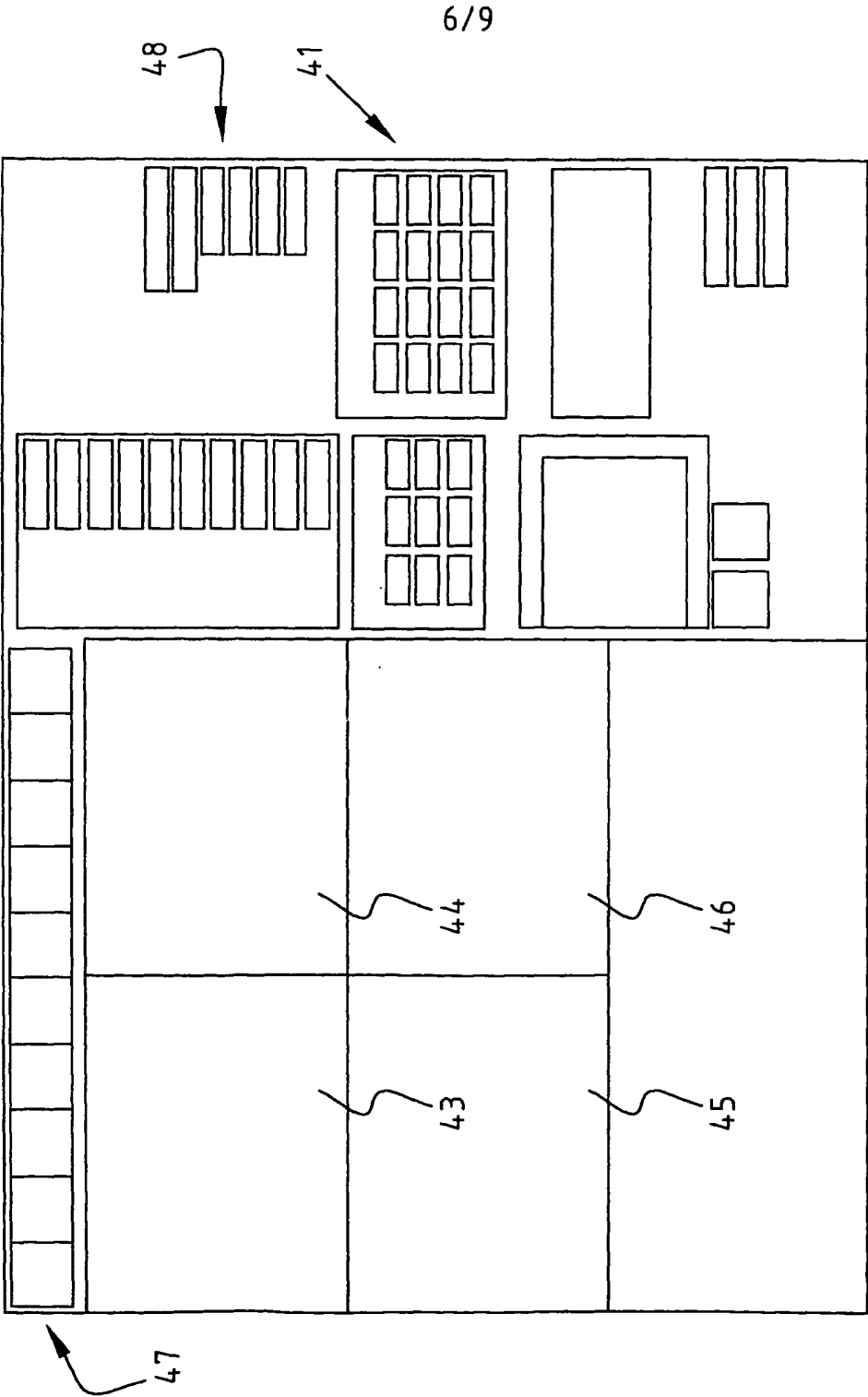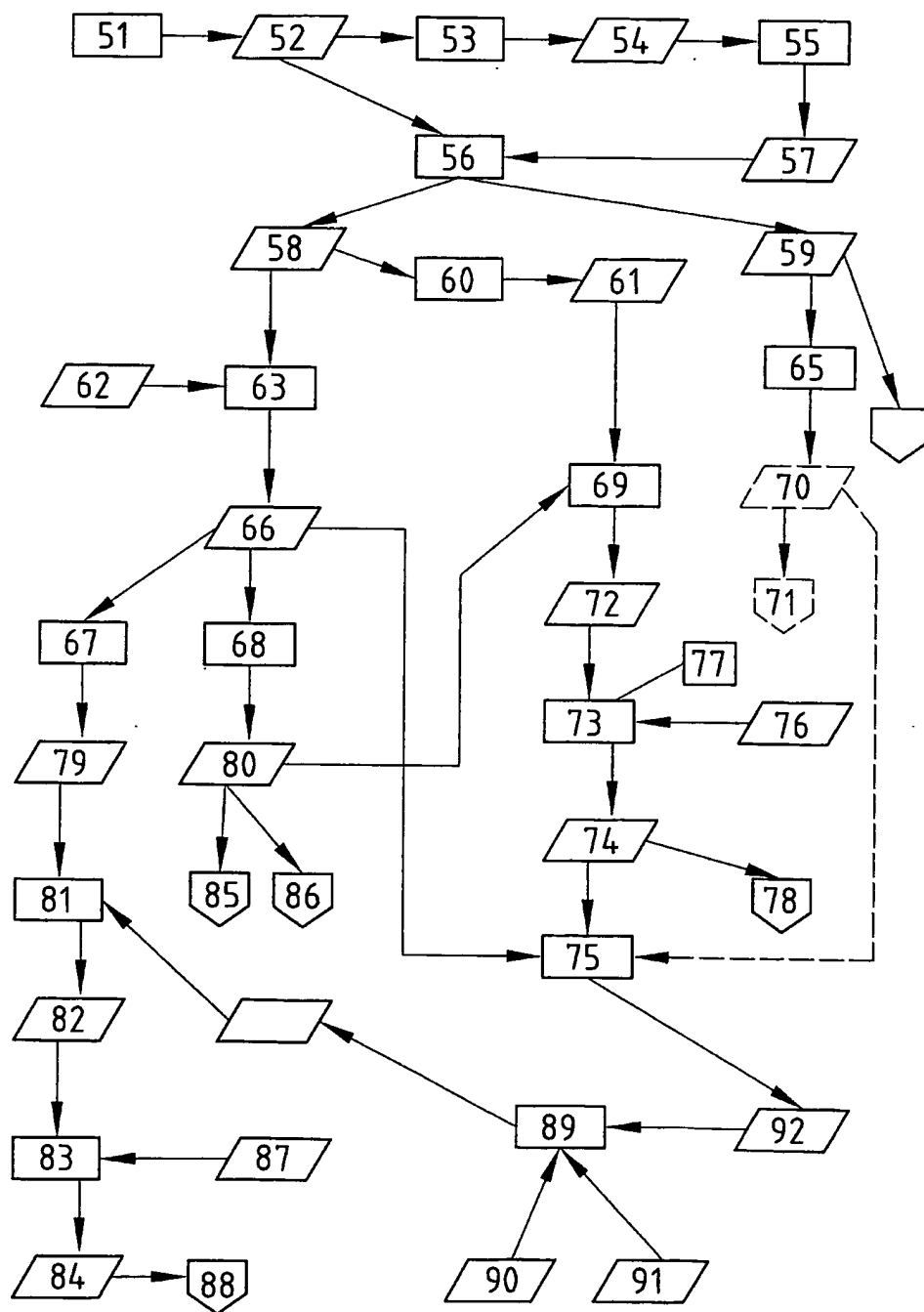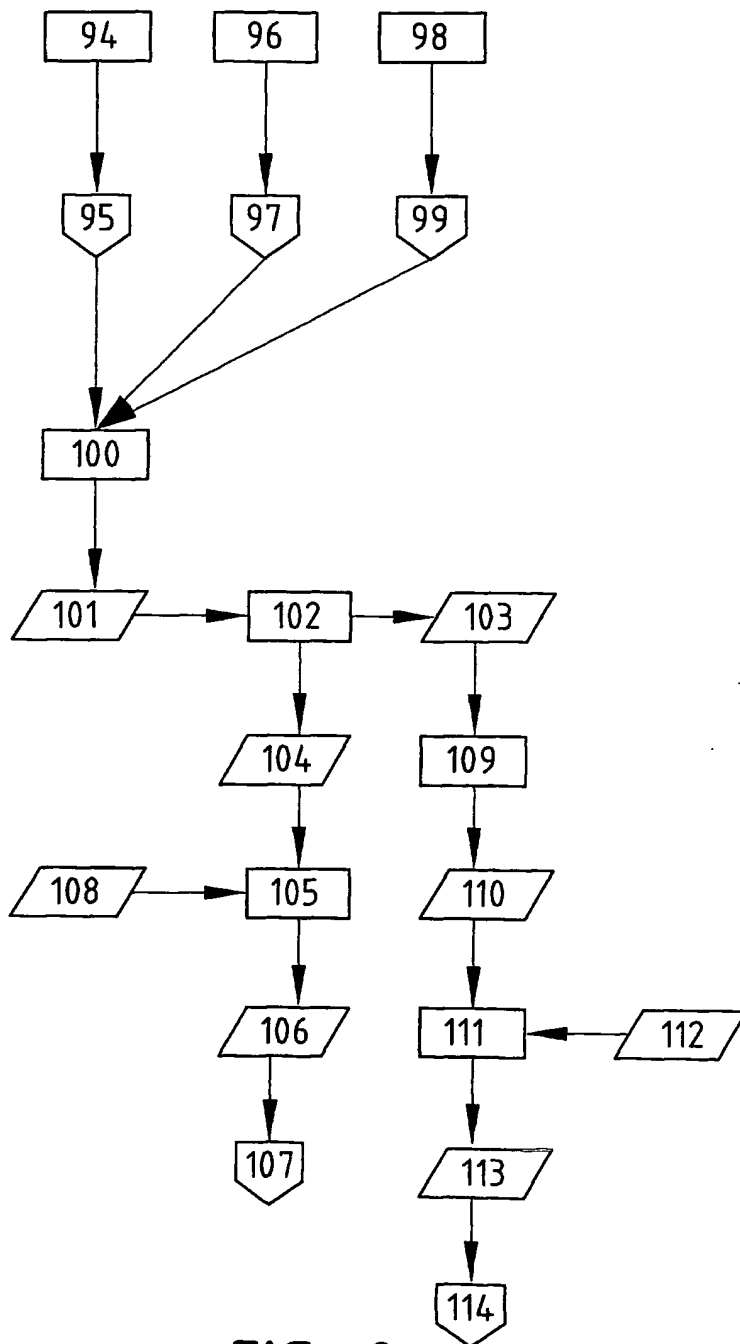
FIG. 9

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FIG. 10

INTERNATIONAL SEARCH REPORT

Internati ‑ ‑plication No

PCT/NL u2/00750

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7   G01N21/90   G06T7/00   G06T5/50

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7   G01N   G06T   G06K   H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

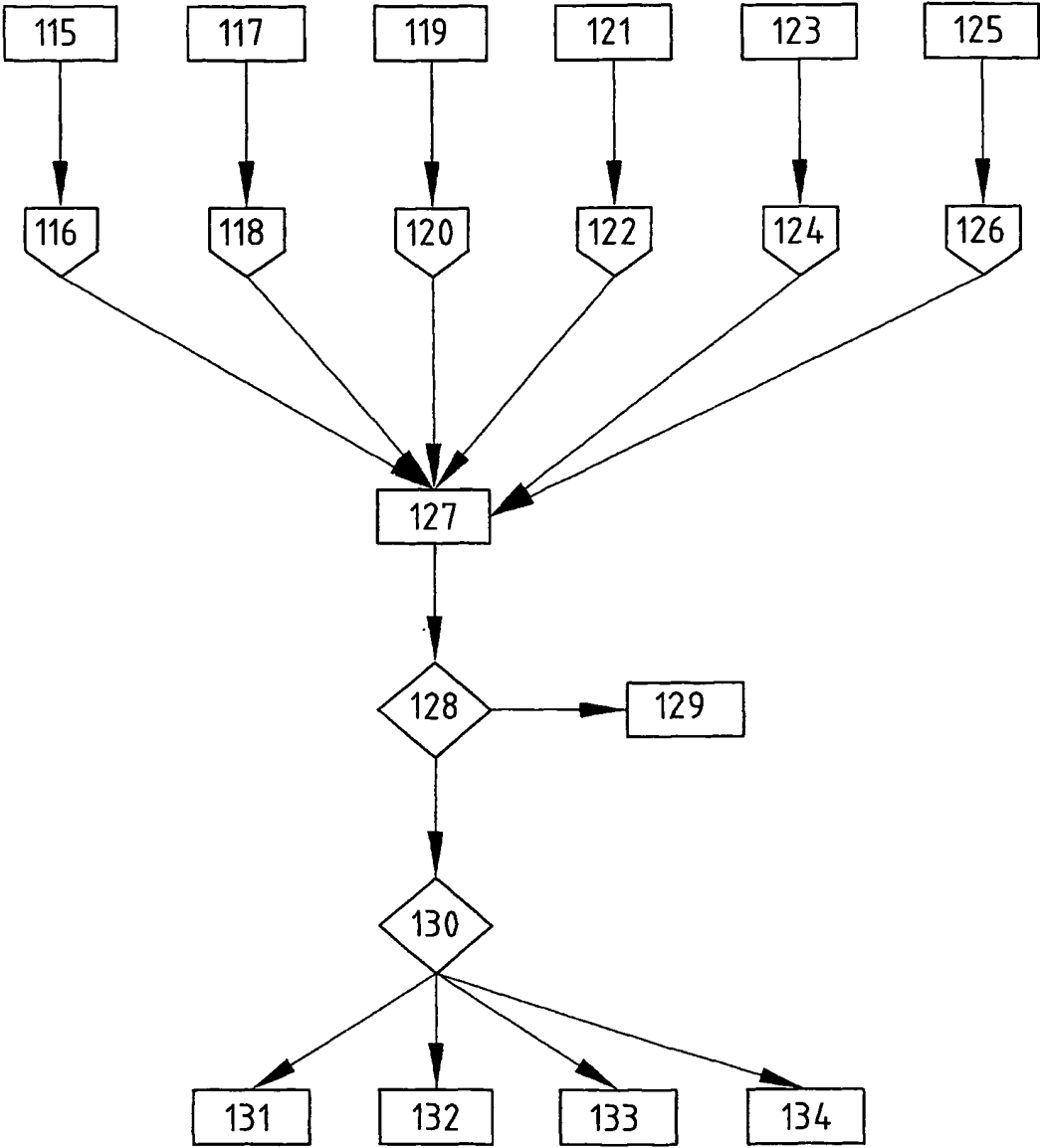Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 859 863 A (GOFF DOUGLAS J ET AL) 22 August 1989 (1989-08-22) column 1, line 7 – line 19 column 3, line 37 –column 4, line 49; figure 1 column 5, line 41 – line 57; figure 3 column 7, line 13 –column 8, line 23 —— -/--	1-12, 16-19, 21-23,28

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
11 February 2003	19/02/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040. Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Duijs, E

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PCT/NL 02/00750

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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